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THE UNITED STATES FISH COMMISSION.

BY CHARLES H. STEVENSON.

UNLIKE the mineral, forestry and agricultural resources of the country, the fisheries can be appropriated and conserved by individuals only in part, and consequently must in a large measure be maintained by the Government for the use of the people in common. The term "fisheries" is here used in its broad and popular sense, signifying the exploitation of all products of the seas, rivers and lakes, including the taking of mollusks, crustaceans, sponges, aquatic mammals, etc., as well as of fish proper.

The responsibility for conserving and developing the fisheries of America is entrusted to the United States Commission of Fish and Fisheries, or, as it is generally known, the United States Fish Commission. The purpose of this article is to set forth briefly the origin of this branch of the Government service, the general work which it has in hand and some of the accomplished results.

While the present organization and functions are the result of various enactments of Congress made from time to time during the last thirty years, the original enactment establishing the Commission was a joint resolution approved on January 9th, 1871. For several years immediately preceding that date, there had been a great scarcity in the supply of food-fish on the Atlantic seaboard, and especially along the coast of southern New England. The States of Massachusetts and Rhode Island were especially interested, and each appointed a legislative committee to investigate the matter. The reports of these committees differed greatly, and the controversy became so extended, that many prominent individuals and scientific associations whose intimate acquaintance with the subject entitled them to recognition urged upon Congress the necessity of a careful inquiry into the cause of the decrease, and the requisite remedial measures. In response thereto

Congress provided for the appointment, from among the civil officers of the Government, of one person of scientific and practical acquaintance with the fishes of the coast, to be Commissioner of Fish and Fisheries, to serve without additional salary, whose duty it should be to investigate and report to Congress whether any and what diminution had occurred in the quantity of food-fishes on the coast and lakes of the United States, the causes of the same, and whether any and what protective, prohibitory or precautionary measures were required.

The qualifications and restrictions relative to the appointee to the office practically limited the choice to Professor Spencer F. Baird, then assistant secretary of the Smithsonian Institution, and in charge of the National Museum. Indeed, it was to provide especially for his appointment that the bill was thus phrased. On the appropriation of $5,000 to meet the necessary expenses of the investigation, he immediately secured a corps of assistants and entered upon the inquiry.

So impressed was Congress with the importance of the work inaugurated that, in the following year, an appropriation of $5,000 was made to continue the investigations during the year 1873, and $15,000 was provided for the introduction of shad into the waters of the Pacific coast, of the Gulf States, and of the Mississippi Valley; and of salmon, white-fish, and other useful food-fishes into American waters to which they are adapted.

This was not the origin of fish-culture in America. The artificial fertilization and hatching of fish-eggs had been discovered in Germany more than a century before, but it did not attract much attention until the success of the work in France about 1850. The subject met with considerable favor in the United States; and, previous to 1872, several States maintained hatcheries for the purpose of stocking their respective waters. Most prominent among these were Massachusetts, Connecticut, New York, Maine and California.

The fish-hatching work of the Commission met with such popular approval and was productive of so great benefits that, in each succeeding year, the appropriations were renewed on a gradually increasing scale; and in a few years the United States Fish Commission ranked foremost among the fish-cultural organizations of the world.

The investigations of the fishery problems were likewise continued and extended in scope from time to time. In the first ten years, these were conducted principally on the New England coast, although valuable work was done elsewhere. Headquarters were established at some point on the coast, usually at a different place each year; and the biological and economic investigations were carried on together by the Commissioner and his staff of assistants, which consisted almost entirely of volunteers, and principally of well-known specialists and advanced students from institutions of learning. In 1881, a permanent station was established at Woods Holl, Massachusetts, and since then most of the biological work on the New England coast has been conducted at that place.

While the collection of statistical data was an important part of the first work of the Commission, the inquiry was restricted to special regions and did not cover the coast in a comprehensive manner. Owing to the limited means available, it was not possible to do much work on this line until 1879, when arrangements were made with the Director of the Tenth Census whereby the Commission was financially aided in making a comprehensive investigation of the commercial fisheries of the entire country. Not only were the economic conditions canvassed, but a large amount of data was secured relative to the biology and natural history of the objects of fishery pursuit. Those data were published in seven quarto volumes, which included nearly all that was then known relative to the fisheries and fishery industries of the United States.

The work continued along these lines, gradually increasing in scope and efficiency, until the death of Professor Baird on August 19th, 1887. Dr. G. Brown Goode succeeded him in the assistant secretaryship of the Smithsonian, and at the request of the President he temporarily assumed the commissionership.

The sixteen years of Professor Baird's wise and energetic management may be regarded as the experimental and developmental period of the Commission, and a necessary preliminary step to the more practical and extensive operations of the last fifteen years. A large amount of biological and economic data had been obtained for trustworthy guidance and the culture of fish had passed from an experimental to an industrial stage. A corps of trained biologists, economists, and fish-culturists had been brought together, and the equipment secured for carrying on the work comprised two steamers, one schooner, and sixteen hatching stations, with the necessary outfit and appliances.

During the whole of Professor Baird's term as Commissioner, he had served as assistant secretary and later as secretary of the Smithsonian Institution, and he also had charge of the National Museum; and a similar condition prevailed while Dr. Goode was Commissioner. These offices, however, had grown far beyond the scope of one man's direction. Consequently, on January 20th, 1888, the law was modified to permit the appointment of a Commissioner who should give his entire and undivided attention to the work, thus freeing the office from intimate association with any other department of the Government service.

Following this enactment, Colonel Marshall McDonald was appointed Commissioner, and served until his death on September 1st, 1895. He was succeeded by the Hon. J. J. Brice, and in 1898 the latter was succeeded by the present Commissioner, the Hon. George M. Bowers. In the meantime, the work of the Commission has greatly increased, and is now more than twice as extensive as it was in 1887, a very large part of this increase, especially in fish-cultural work, having occurred within the last four years.

The origin and development of the Commission having been outlined, it now remains to describe the organization and its principal functions. Aside from the general administrative offices, which need not be noted here, there are three large divisions which correspond to the three principal functions of the service. These are (1) the Division of Inquiry respecting Food-Fishes and Fishing Grounds, (2) the Division of Fisheries, and (3) the Division of Fish-Culture. This organization is based on the different kinds of work to be performed; and while the three divisions are entirely separate and distinct, each having its responsible head and personnel, they work in harmony and mutually aid one another in forwarding the general fishery interests. The work of each of these will be set forth separately.

(1) *The Division of Inquiry respecting Food-Fishes and Fishing Grounds.* The principal work of this division is a study of the fishes and other objects of fishery pursuit, including their embryology and life history, their food, diseases, conditions of growth, methods of culture, etc., and likewise the biological and physical characteristics of the seas, lakes, and rivers in which they occur. In order to understand the various fishery problems, it is

necessary to know the life history of all aquatic animals and plants, and it is equally important to understand the physical conditions of the water, such as density, currents, temperature, etc. These inquiries are conducted with a view to practical results and conclusions rather than the advancement of science, although it is the policy of the Commission to afford every reasonable means for advancing knowledge of aquatic biology.

The work of this division is performed by a corps of scientific naturalists and biologists, whose training qualifies them to deal with the problems involved. In addition to the regular personnel, most efficient services are rendered by volunteers, including some of the most skilful of American specialists.

A large part of the investigations are prosecuted at the marine biological stations maintained at Woods Holl, Massachusetts, and Beaufort, North Carolina. These are resorted to by eminent zoölogists from all parts of the country, who avail themselves of the facilities there afforded for studying aquatic biology; and the Commission has the benefit of the many important investigations there carried on. In addition to this, field parties are assigned to various parts of the country to study special problems, and to develop knowledge of the resources of the waters and the geographical distribution of aquatic products.

Many experiments relating particularly to extension of the fishery resources are likewise conducted. Among the special experiments in progress at the present time are those relating to the growing of sponges from cuttings, the rearing of lobsters, the cultivation of clams, and the fattening of oysters for market.

An important work of this division since 1887 has been a systematic survey of the oceanic fishing grounds, especially those not previously exploited, in order to make the present resources known to the fishery interests. This work has been performed largely by the vessels owned by the Commission. In accordance with the law, and through the courtesy of the Secretary of the Navy, naval officers have been detailed to these vessels, an arrangement which has resulted in mutual benefit to the two branches of the service.

(2) *The Division of Statistics and Methods of the Fisheries.*— For the sake of brevity this division is commonly known as the Division of Fisheries. Its function is also that of investigation; and while the work of the Division of Inquiry respecting Food-

Fishes and that of the Division of Fisheries may overlap in certain particulars, yet in general the former relates especially to conserving and extending the aquatic resources, while the latter is concerned with the best and most extensive utilization of those resources. This division deals with the economic phases of the fisheries themselves, such as the collection of statistical data, the study of the apparatus and methods of capture with special reference to their utility and their effect on the fisheries, the best methods of utilizing the products, the effects of fishery legislation and international fishery relations, and all other matters affecting the economy of aquatic resources. The work is carried on by trained experts who visit the fishery sections to study the conditions, while in some important centres special agents are permanently located.

The collection of statistical data constituted a part of the work of the Commission from its origin. The Halifax Convention of 1877, which determined the amount of the award to be paid by the United States to the Canadian Government on account of the privileges granted by the Treaty of Washington, emphasized the necessity of having at hand accurate and comprehensive statistics of the fisheries and the impossibility of judicious legislation without them. It has been confidently asserted by persons whose experience qualifies them to speak, that the results of that convention would have been far different, and the United States would not have been called upon to pay the award of $5,500,000, if it had possessed such statistical data as are now available.

Since 1888, the small amount of funds available annually for this work has enabled the division to make a canvass of the entire country every four or five years, and thus keep a fairly continuous record of the condition in every section. These data furnish a guide for determining the direction and results of fish-culture, and they are also of the greatest service in the study of fishery problems and in connection with fishery legislation.

The work of this division also includes a study of the apparatus and methods of the fisheries, with a view to discouraging the use of those which are especially injurious, and the introduction of full information relative to the most approved methods of capture devised in this and other countries.

Another important function of the Division of Fisheries is the dissemination among American fishery interests of information relative to the utilization of fishery products, including methods of refrigeration, drying, pickling, canning, and other processes of preservation for food, and also their employment in the arts and industries. This is a very broad and important subject, and it is receiving special attention in the divisional work. The thorough utilization of the present resources is no less important than the extension of those resources. In few countries has greater care been given to the preparation of fishery products than in America; yet there are many additional methods that could be employed advantageously. Numerous products highly valued in Europe and Asia are never used here, although abundant in our waters, and a large part of our resources are undeveloped through a failure to appreciate and follow the foreign methods. Herring, for instance, is one of the most abundant species on the American coast, obtainable nearly every season in much larger quantities than can be handled; yet the United States imports annually over $2,000,000 worth of herring products. Millions of dollars worth of oil, fertilizer, glue, skins, shells, seaweeds, etc., are annually wasted in this country through a lack of information as to the proper methods of manufacture. The use of the Mississippi pearl-shells illustrates the importance of this work. Twelve years ago they were of no market value whatever. The method of using them in button-manufacture was then introduced, and that industry now employs over 5,000 persons in America.

The prosperity of the fisheries is likewise enhanced by extending the foreign fishery trade. In case of some products, the foreign demand is of as much importance as the home market, and the fluctuations in that demand are of great consequence to the fishery interests. The value of our annual exports of fishery products approximates $7,000,000, but that it is not nearly so great as it might be is apparent from the fact that more than $100,000,000 worth of fishery products are imported into various foreign countries. The Division of Fisheries devotes considerable attention to this subject, studying the foreign markets, the prevailing trade conditions, the special articles that may be disposed of, and the particular methods of preparation suited to the foreign demand.

(3) *The Division of Fish-Culture.*—The work of this division consists in the hatching and distribution of fish for the maintenance and increase of existing fisheries, and for the establishment of new resources. As regards the amount of money expended and

the number of persons employed, this is by far the most extensive branch of the service, although it was not contemplated when the Commission was established.

This division now operates thirty-five hatcheries, four railroad cars for distribution, and an extensive equipment for carrying on the work. Two stations in Maine, at Green Lake and Craig Brook, are used for cultivating the Atlantic and landlocked salmon for distribution in New England and adjacent territory. At Gloucester and Woods Holl, Massachusetts, cod, lobster, flat-fish, and other marine species are propagated. The hatching operations of the steamer "Fish-Hawk" in Delaware River, Battery Station and Bryan Point in Maryland, Edenton in North Carolina, and the stations in Washington, D. C., are devoted principally to shad, which are distributed all along the Atlantic seaboard. Hatcheries on the Great Lakes at Cape Vincent, New York; Put-in-Bay, Ohio; Detroit, Alpena, and Sault Ste. Marie, Michigan; and Duluth, Minnesota, are devoted to white-fish, pike perch, lake trout, lake herring, etc. At St. Johnsbury, Vermont; Nashua, New Hampshire; Wytheville, Virginia; Erwin, Tennessee; Cold Spring, Georgia; Northville, Michigan; Quincy, Illinois; Manchester, Iowa; Neosho, Missouri; San Marcos, Texas; Leadville, Colorado; Spear Fish, South Dakota; and Bozeman, Montana, the work is principally with brook trout, black-spotted trout, grayling, rainbow trout, black bass, crappie, bream, and the like. Six stations are maintained on the Pacific seaboard for the cultivation of the various Pacific salmon.

The output of fish fry and eggs from these hatcheries during the year ending June 30th, 1902, amounted to 1,488,673,000. The principal species were as follows—white-fish, 594,490,000; pike perch, 237,099,000; cod, 212,001,000; flat-fish, 168,133,000; shad, 104,986,000; lobster, 81,020,000; salmon, 53,599,000; lake trout, 27,257,000; brook trout, 6,142,000; grayling, 1,785,000; and rainbow trout, 1,183,000. Of yearling and adult fish 6,870,000 were distributed, the principal items being 2,006,000 shad, 1,488,000 black-spotted trout, 735,000 crappie, 606,000 sunfish, 492,000 rainbow trout, 437,000 brook trout, 381,000 salmon, 262,000 black bass, 77,000 steel head trout, and 37,000 rock bass.

The results attendant upon these fish-hatching and distribution operations have been exceedingly gratifying. Millions of pounds of fish are now captured in waters originally stocked by the Commission, and equally favorable results have followed plantings made in native waters for the purpose of restoring depleted fisheries. Thousands of small lakes and streams throughout the country are now supplied with food and game fish entirely new to those waters. On the Pacific coast the results are especially striking. The small plantings made there of shad and striped bass have resulted in making these non-indigenous fish abundant along a large section of the coast. The confidence placed in fish-culture by the salmon interests on the Pacific is practically universal, and some of the canners have even established private hatcheries at their own expense.

There seems to be no reasonable doubt that the perpetuation of the extensive shad fisheries on the Atlantic seaboard is largely the result of artificial propagation. The adverse agencies, such as dams across the rivers, sawdust, chemicals, and other refuse, and the extensive fisheries, have reduced natural reproduction to almost an insignificant factor in the maintenance of the fisheries, and make them almost wholly dependent on artificial propagation. The increased catch of shad since 1880, when the results of hatching operations began to appear, now approximates 8,000,000 in number annually. At twenty-five cents each, which is about the average price paid by consumers, this represents an increase in value of $2,000,000, fifty times the outlay for shad propagation.

The work of fish-culture has met with so much success that many persons consider it more advisable to spend money for the hatching and distribution of fish, with a view to making them so abundant that they may be caught without risk of depleting the resources, than to spend an equal amount in policing and restricting the fisheries with a similar object in view.

A consideration of the work already accomplished by the Commission in its several departments recently drew from a prominent Congressman and financier, a member of the House Committee on Merchant Marine and Fisheries, and therefore competent to speak, the statement that " there is no expenditure on the part of the Government which results in greater economic benefit to the country at large than that applied to fostering the fisheries."

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